

# Navigating *the* Waters

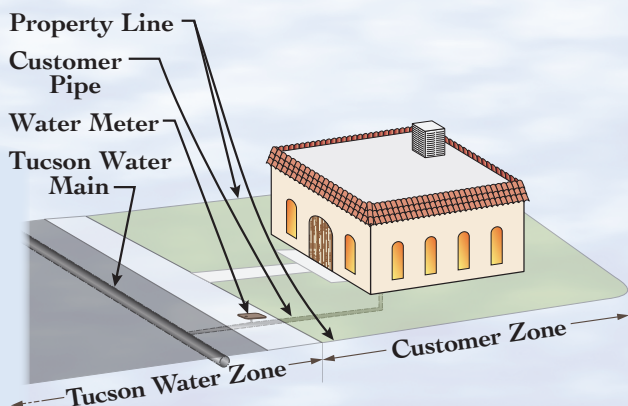
Your Guide to Home  
Treatment Systems



**T**ucson Water is proud of the quality and safety of drinking water delivered to your home. Each year Tucson Water engineers, technicians, chemists and other professionals use the most advanced monitoring equipment available to perform more than 400,000 individual tests on our city's drinking water supply. This activity, which exceeds the requirements of the federal Safe Drinking Water Act, coupled with our disinfection and operational strategies, protects against microbes, organic and inorganic compounds as well as trace elements in our drinking water.

Consumers need to be aware that they are responsible for the water quality in the 'customer zone', an area from the water main to the tap. The condition of internal plumbing, as well as the service pipe that connects to the water main, can impact customer zone water taste and quality. A home water treatment system may be an option to explore.

With many water treatment options currently available, it's important for consumers to understand that each system has its pros and cons when it comes to filtering water. Tucson Water has developed this short guide to assist you in determining which system best fits your home water treatment needs.



## WATER FACTS AND REMINDERS

- All water sources contain minerals and some contaminants. If a water source meets the standards set by the U.S. Environmental Protection Agency (USEPA), National Primary Drinking Water Standards (NPDWS), and National Secondary Drinking Water Standards (NSDWS), it is considered safe to drink.
- No water treatment device can completely eliminate all minerals and all contaminants from water all of the time.
- Proven treatments, if properly operated and maintained, can reduce contaminants below NPDWS and/or NSDWS levels.
- Before buying a home water treatment device, know the quality of your water source and decide
  - a) which contaminants you want reduced,
  - b) to what level, and
  - c) how much treated water you need every day.
- Home water treatment devices can break down and, if misused, can contaminate your drinking water.
- Home treatment devices require regular use and periodic maintenance. They are not "install and forget" devices.

**Source: Arizona-Know Your Water.**

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# SELECTING A HOME TREATMENT SYSTEM

POE is a device that treats all or most of the water entering the home. POU is a device that treats water at a particular tap. When choosing a home water treatment system, it's important to remember that no single unit can remove all the elements that may be present in drinking water. Operating and maintenance costs should also be considered in addition to what you would like to remove from the water.

There are two principal categories of home treatment devices: point-of-entry (POE) and point-of-use (POU).

they do not remove total dissolved solids (minerals) or reduce water hardness. Costs for carbon filters range from \$7 to \$150, and depend upon the size, type, and capacity of the filter installed.

## ACTIVATED CARBON FILTERS

Activated carbon filtration may be selected to reduce unwanted tastes, odors or organic chemicals (such as disinfection by-products from the chlorination process) from drinking water. They will not soften water or disinfect it. Activated carbon filtration makes use of a specially manufactured charcoal material composed of porous carbon particles to which most organic contaminants are attracted and held on/in the porous surface. Costs range from \$30 to more than \$800, depending upon the system.

# FILTRATION SYSTEMS

or business. Different filters have functions that are specific to different elements and can range from removing sediment (particles) to absorbing one or more specific elements.

## PARTICLE FILTERS

Particle filtration is a process that removes small amounts of suspended particles from water, ranging in size from sand to clay. Home filters can be used alone or ahead of other water treatment devices, but are not intended to filter large quantities of particles.

## CARBON FILTERS

A simple and inexpensive way to improve the taste of your water is with a carbon filter. These filtration systems can vary from pitchers and portable containers outfitted with disposable carbon filters to large carbon filters that treat water as it enters your home or business. The filter absorbs many compounds that are responsible for taste and odor problems, including chlorine. These simple systems are very effective at improving the taste of drinking water, and they work well as long as the filter is replaced according to the manufacturer's directions. However,

Filtration systems can vary from pitchers, or portable containers outfitted with disposable filters, to more complex systems that treat water as it enters your home

Reverse osmosis uses a membrane that is semi-permeable, allowing water molecules to pass through it, while rejecting other constituents. This process removes particles as small as ions from the water. Reverse osmosis is used to purify water and to remove salts, common materials, and multiple contaminants to improve the color, taste, softness and other properties of the fluid. The effectiveness of reverse osmosis systems depends upon the membrane type, water pressure and the amount and properties of each contaminant. These treatment systems average about \$300 and are typically installed beneath your kitchen sink or other point-of-use locations, such as underneath a bathroom sink. Filters and membranes must be changed according to manufacturer's directions in order for the system to work properly. Keep in mind that Reverse Osmosis will:

- Remove trace elements provided by tap water.
- Increase the salt load in waste water, which could impact sewer treatment cost.
- Create one or more gallons of salty waste stream for each gallon of treated water.

Consumers should be aware that chlorine can have a negative effect on some reverse osmosis membranes. Carbon pre-filters may be used to remove chlorine, but are not necessary if the reverse osmosis system contains a cellulose tri-acetate membrane.

# REVERSE OSMOSIS

## MULTIPLE BARRIER APPROACH

Two or more water quality treatment technologies used together constitute a multiple barrier approach. When combined, these technologies utilize a system of barriers that enhance the water treatment process at your home.

Research from the University of Arizona's Department of Soil, Water and Environmental Science has shown that properly designed and operated home point-of-use water treatment systems, such as a system comprised of a pressed activated carbon block filter and an ultraviolet light reactor, have been determined to be an effective and practical option for consumers, especially those who are dependent upon shallow groundwater as a source of drinking water, or for consumers in small rural communities.

Study results further revealed that this type of household treatment was capable of reducing the level of bacteria, virus and protozoan pathogens by 99.9%.

According to the World Health Organization (WHO), there are several technologies for household water treatment and storage that are accessible, simple and economical to use. Some of these treatment methods are for protection from microbes and waterborne diseases. Each treatment method has variables around community acceptance, sustainability and cost. Of the treatment methods now available, the following appear to be the most widespread and promising for further development as multiple barrier systems:

- Boiling
- Solar disinfection by the combined action of heat and UV radiation
- Solar disinfection by heat alone ("solar cooking")
- UV disinfection with lamps
- Chlorination plus storage in an appropriate vessel
- Combined systems of chemical coagulation-filtration and chlorine disinfection

All of the above individual household water treatment technologies have been tested independently. The treatments that provide no residual disinfectant, such as boiling, solar treatment, or UV disinfection with lamps and filtration, could be

followed by chlorination and storage in a protected vessel. Further research and demonstration of such multiple barrier treatment and storage approaches have been recommended and are the next steps in the development, evaluation and implementation of improved treatment and storage of water at the household level.

According to one manufacturer of a multiple barrier water treatment system currently on the market that combines ozonation, UV light exposure/photo oxidation and high-density carbon block filtration into one unit, the cost can start at \$500.



Self-serve water stations and water vending machines appeal to consumers who want convenience and prefer to avoid the cost associated with the

installation and maintenance of an additional home treatment system. (Consumers typically use and haul water in their personal containers.) Both self-serve and vending machine businesses are required to undergo inspection by local health departments. However, both have other health considerations that consumers should be aware of: water stations are not subject to the stringent governmental regulations imposed upon municipal drinking water supplies and water dispensing machines can be vulnerable to contamination if not properly maintained by the vendor.

The cost per gallon may vary for self-serve station and vending machine water. Vending machine water is reconditioned water from the municipal water supply that may not be any softer than tap water unless a reverse osmosis unit is used as part of the treatment. It can cost \$0.25 to \$0.35 per gallon and as much as \$0.50 per gallon for cold water. Costs can range from \$0.50 to \$0.60 per gallon of water at a self-serve station. Tucson Water residential customers pay about \$0.002 per gallon of delivered tap water.

## SELF-SERVE WATER STATIONS AND VENDING MACHINES





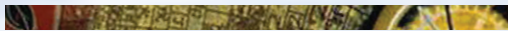
## WATER SOFTENERS

Water softening reduces the hardness of water coming into homes and businesses. Hard water causes a higher risk of lime scale deposits in water systems. Due to this lime scale build-up, the flow of water through the pipes can be restricted and the efficiency of hot water heaters can be reduced. It can also increase the cost of domestic water heating by about fifteen to twenty percent. In addition, it can shorten the lifespan of water-using appliances such as dishwashers. It also has an impact on the lifespan of solar heating systems, air conditioning and evaporative cooling systems.

A water softener collects hardness minerals, such as calcium and magnesium, within its conditioning tank and from time to time, flushes them away to the sewer or septic system. A maintained water softener will last many years. Softeners that were supplied in the 1980s may still work, and many need little maintenance besides filling them with salt occasionally. Retail prices for home water softeners may range from approximately \$400 to \$1,200 depending on the size and type of softener. Softeners are rated by the total number of grains of hardness the unit can remove before being recharged. (One grain of hardness is the equivalent of 17.1 milligrams of calcium and/or magnesium.) The cost for sodium or potassium salt is approximately \$5 to \$7 per 40-pound bag depending on the form purchased.

There are two types of water softeners: resin-based and salt-based water softener systems. A few things to keep in mind when considering water softeners –

- If salt-based, they increase the salt load in wastewater, which could impact sewer treatment costs
- A waste stream is created, which uses additional water, increasing water and sewer costs



## DISTILLATION SYSTEMS

Distillation changes drinking water into steam, and then condenses that steam back into water. This process effectively removes suspended minerals, metals and particulates from water. Since distilled water has no minerals, some people

claim distilled water tastes flat or slightly sweet. Distillation also kills or removes microorganisms, including most pathogens, and can also remove some organic compounds, depending on the chemical characteristics of the compounds.

As with all home water treatment systems, distillation units require some level of regular maintenance to keep the unit operating properly. The boiling chamber needs to be regularly flushed out, which generates wastewater. Purchase price can range from \$250 to \$1,450, plus distillation systems are also high-energy users.

Some home distillation units have activated carbon filters to remove Volatile Organic Compounds (VOCs) such as benzene and TCE. VOCs can also re-contaminate distilled water or indoor air if not properly vented or captured.



Ever notice how the water is always crystal clear in a wishing well? That's because of the natural ions

given off from the pennies and dimes people toss in. Pioneers used copper and silver coins in their water barrels to keep their water fresh and safe to drink. Manufacturers have developed chlorine-free treatment systems that make use of the natural ability of some metals to sanitize water.

How do these water systems work? According to one manufacturer, water first passes through an oxidation ionization chamber. This chamber has one set of titanium plates and one set of copper plates. When water is running, the unit energizes the plates. The titanium and copper plates oxidize the organic compounds in the water, kill bacteria, and dissipate inorganic impurities.

The water then goes through a large activated carbon filter. The activated carbon removes odors, chlorine, metals, chemicals and off tastes. It automatically backwashes and recycles itself at night whenever the preset amount of water usage or elapsed time has occurred.

Chlorine-free systems may also add salt to wastewater. Costs for chlorine-free systems typically range from \$100 to \$800.

## CHLORINE-FREE SYSTEMS



TREATMENT SYSTEM	PROS	CONS
<b>Particle Filters</b>	Remove small amounts of suspended particles ranging in size from sand to clay.	Not intended to filter large quantities of particles.
<b>Carbon Filters</b>	Simple, inexpensive way to improve water taste.	Do not remove total dissolved solids such as minerals.
<b>Activated Carbon Filters</b>	Reduce unwanted tastes, odors and organic chemicals.	Does not soften water or disinfect it
<b>Reverse Osmosis</b>	Purifies water and removes salts. Conveniently installed under kitchen sink or other point-of-use. Bacterial and contaminant removal effectiveness depends upon membrane type, water pressure and the amount/properties of each contaminant.	Some units can waste up to 10 gallons of water to produce one gallon of treated water; also adds salts to wastewater.
<b>Multiple Barrier Approach</b>	Combines two or more barrier methods into one treatment approach; effective at improving and maintaining microbial water quality.	Can be expensive.
<b>Self-Serve Water Stations</b>	Less expensive than home treatment system installation and maintenance.	Consumers must haul their own water; also not subject to stringent government regulations imposed upon municipal drinking water suppliers.

TREATMENT SYSTEM	PROS	CONS
<b>Water Vending Machines</b>	Easily accessible; found outside grocery and convenience stores.	Expensive, uses reconditioned tap water; customers must provide their own containers and haul their own water.
<b>Water Softeners</b>	Prevents material build-up on pipes (reduces lime scale deposits); can provide many years of service.	Adds salt to wastewater and generates a large volume of water waste, as well as increasing sewer treatment costs.
<b>Distillation Systems</b>	Removes contaminants (organic and inorganic) and kills or removes microorganisms.	Volatile Organic Compounds (VOCs) can re-contaminate distilled water or indoor air if not properly vented; also a high energy user.
<b>Chlorine-Free Systems</b>	De-scale pipes, hot water heaters, faucets, dishwasher and shower heads, eliminates hard water deposits; systems kill and remove bacteria.	Chlorine-free water cannot be stored in containers or trapped in water lines for long periods of time, since bacteria will grow in the water.

# NEED HELP NAVIGATING THE WATERS? CONTACT TUCSON WATER!

Tucson Water provides timely information about the quality of our tap water via the Water Quality Info Net program. If you have questions or comments about water quality, call (520) 791-5945 or email [WQinfo@tucsonaz.gov](mailto:WQinfo@tucsonaz.gov).

For water quality reports, neighborhood maps, and hot topics, go to the Tucson Water website at [tucsonaz.gov/water/water\\_quality](http://tucsonaz.gov/water/water_quality). To schedule a tour of the Water Quality Laboratory or a speaker for your organization, call the public information office at (520) 791-4331 or email [TW\\_web1@tucsonaz.gov](mailto:TW_web1@tucsonaz.gov).

Esta información está disponible en español. Por favor llame al (520) 837-2465.

*Source (unless otherwise noted): Arizona: Know Your Water, A Consumer's Guide to Water Resources, Quality, Regulations, and Home Water Treatment Options. The University of Arizona, 2004*



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